

AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111

Serial Number: 09/503,553

Filing Date: February 11, 2000

Title: SYSTEM AND METHOD FOR OPTIMIZING PRINTING OF A PHASE SHIFT MASK HAVING A PHASE SHIFT ERROR

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10) taken from one or more simulations of an image on the alternating phase shifting mask.

Applicant respectfully disagrees with the characterizations of the Shiraishi reference made in the rejection. The representation "13a" is a diffraction grating pattern that functions as a luminous flux distribution member (Shiraishi at column 6, lines 6-8). The representation "17" is a light scattering member such as a diffusing plate that scatters light emerging from one point of the diffraction grating patterns and serves for illumination over a wide area of the reticle pattern surfaces (Shiraishi at column 11, lines 39-42). The light scattering member 17 is moved during the exposure period such that it is easier to eliminate the dispersion in the quantity of the illumination light (Shiraishi at column 11, lines 46-50). Further, Applicant is unable to find in the cited portion of the Shiraishi reference a restrictor that provides off-axis illumination and that optimizes printing of the alternating phase shifting mask using empirical data taken from one or more simulations of an image on the alternating phase shifting mask.

Applicant's invention compensates for a phase shift error in a phase shifting mask by adjusting illumination parameters. Applicant is unable to find in the cited portion of the Shiraishi reference a compensation of a phase shift error in a phase shifting mask achieved by adjusting illumination parameters. Rather, the Shiraishi reference states its primary object is *to attain exposure with a high resolving power and large focal depth even when using an ordinary reticle by making the illumination light incident on a mask at a predetermined angle inclined to the optical axis of an illumination optical axis or a projection optical system, providing a member for making the illumination light incident obliquely on the mask in the illumination optical system and illuminating the mask without any loss in light quantity*. [Emphasis added]. Shiraishi at column 3, lines 24-32. Additionally, the Shiraishi reference states: *In accordance with the present invention, it is possible to actualize a projection type exposure apparatus exhibiting a higher resolving power and larger focal depth than in the prior art even by employing the ordinary reticle. Further, although the effect of improving the resolving power competes with a phase shifter, the conventional photo mask can be used as it is. It is also feasible to follow the conventional photo mask inspecting technique as it is. Besides, when adopting the phase shifter, the effect of increasing the focal depth is obtained, but it is hard to undergo influences of a wavefront aberration due to defocus even in the present invention. For*

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this reason, a large focal depth (focal tolerance) is obtained. Shiraishi at column 4, lines 12-24.

With respect to independent claims 23, 27, 29, 32, 34, 36, 39, 43, 57, 59 and 61, Applicant is unable to find among other things in the cited portions of the Shiraishi reference that illumination parameters are adjusted or optimized to compensate for a phase shift error in the phase shifting mask, or means for optimizing printing of a phase shifting mask.

With respect to independent claims 32, 40, 43, 45, 47, 49 and 51, and dependent claims 25, 28, 41 and 55, Applicant is unable to find among other things in the cited portions of the Shiraishi reference a restrictor that uses empirical data taken from one or more simulations of an image on the mask. The portion of the Shiraishi reference cited in the Office Action relates to a main controller system in which the names of a plurality of reticles and operation parameters are registered.

With respect to independent claims 34, 43 and 59, and dependent claims 30 and 52, Applicant is unable to find among other things in the cited portions of the Shiraishi reference a ring that compensates for a phase shift error. Applicant is unable to find a ring that has an inner radius and an outer radius such that light is not passed within the inner radius.

With respect to independent claims 43, 45, 47, 49 and 61, and dependent claims 53 and 55, Applicant is unable to find among other things in the cited portions of the Shiraishi reference sigma in and sigma out parameters are varied to compensate for the phase shift error.

With respect to independent claim 47, Applicant is unable to find among other things in the cited portions of the Shiraishi reference a method for printing an image from a phase shifting mask using an I-line light source at a first wavelength and a deep UV light source at a second wavelength.

Independent claims 23, 27, 29, 32, 34, 36, 39, 40, 43, 45, 47, 49, 51, 57, 59 and 61 are believed to be patentable at least for the reasons provided above. Dependent claims 24-26, 28, 30-31, 33, 35, 37-38, 41-42, 44, 46, 48, 50, 52-56, 58, 60 and 62 respectively depend on independent claims 23, 27, 29, 32, 34, 36, 40, 43, 45, 47, 49, 51, 57, 59 and 61 and are believed to be allowable with them, as well as at least for the additional reasons provided above.

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Applicant respectfully requests withdrawal of the § 102(e) rejection, and reconsideration and allowance of claims 23-62.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 373-6960 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this 12 day of December, 2001.

Tina Pugh
Nroc

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Signature